The Simulation Based Acquisition Vision and an Integrated Engineering Environment

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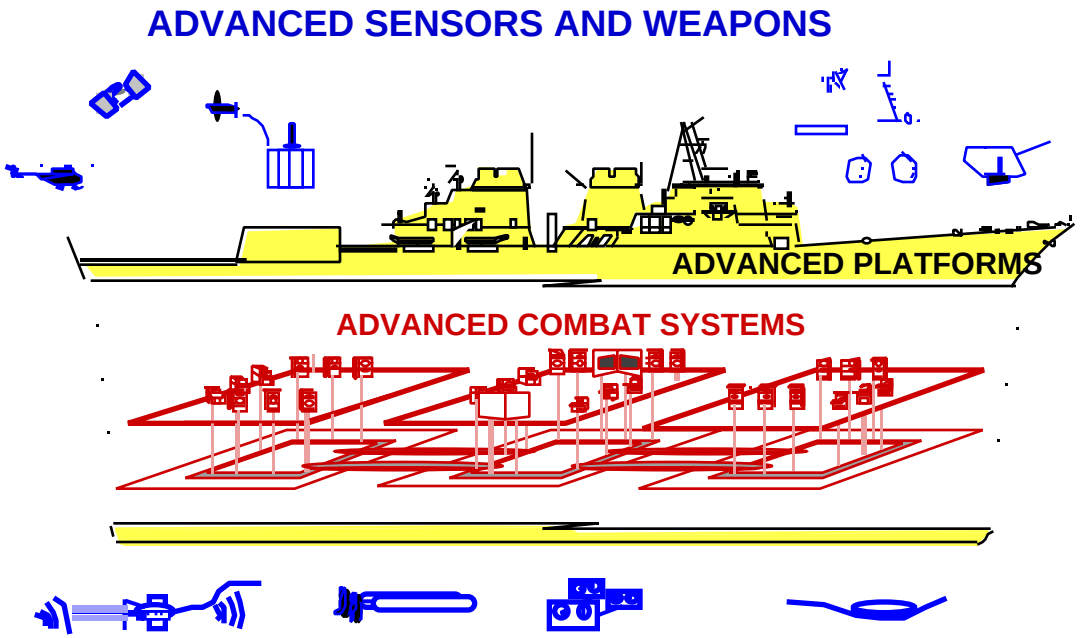
COMPLEX SYSTEM DEVELOPMENT CHALLENGE

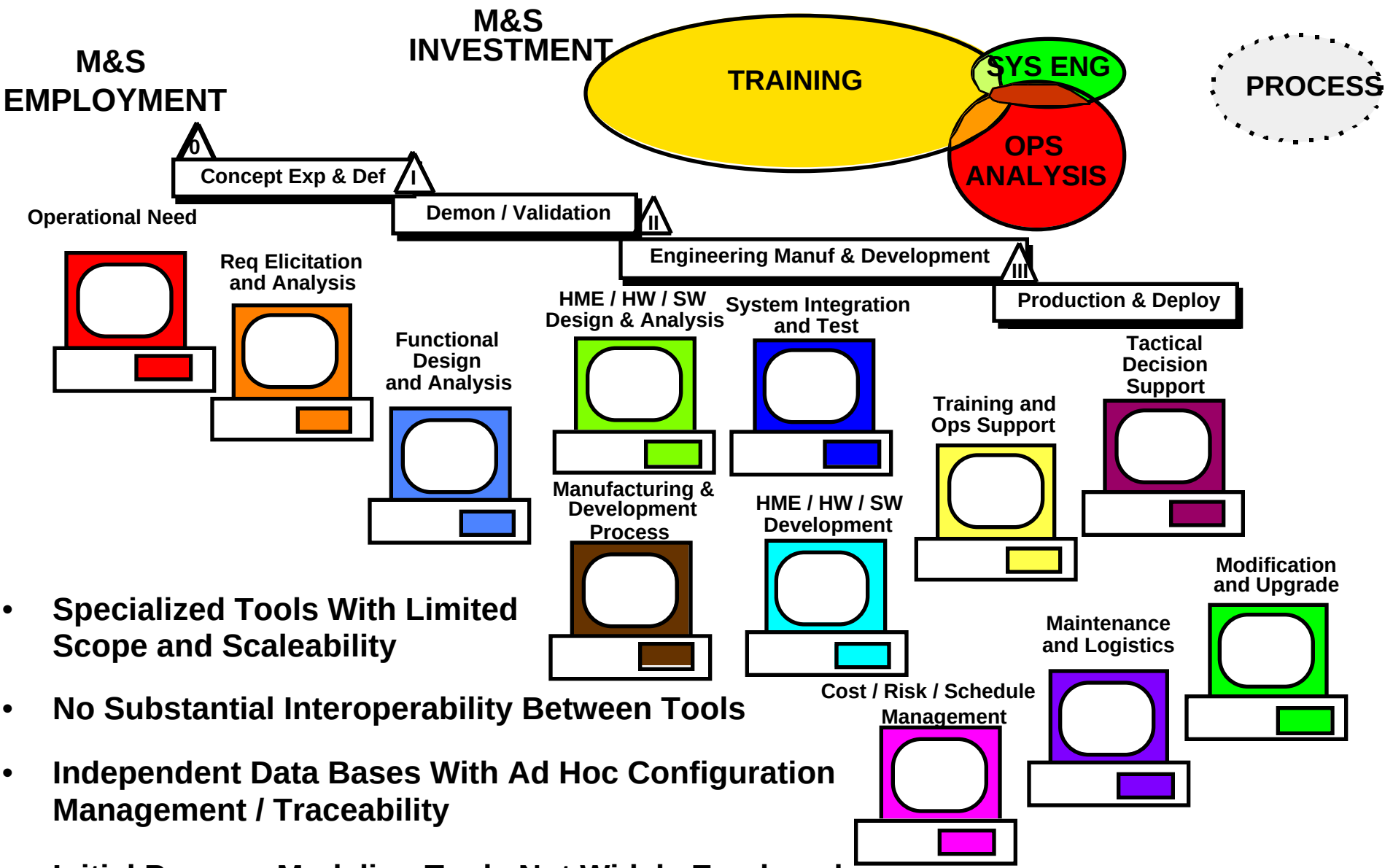


- 21st CENTURY DESTROYER
- NEW ATTACK SUBMARINE
- LPD-17
- CVX
- JOINT STRIKE FIGHTER

- The Complexity and Sheer Magnitude of Modern Combat Systems Represents a Major Design Challenge
  - Hundreds of Processors / Millions of SLOC / New Technologies
  - Complex Management Organization
  - Integration of Multiple Engineering Disciplines

- Goal is to Reduce Complex System Acquisition Life Cycle Cost (and Schedule to IOC) by 50% While Improving Quality & Optimizing Trade-Offs
  - Cannot be Achieved Via Incremental Process Improvement
  - Requires Innovative Focused Employment of Emerging Technologies

MODELING AND SIMULATION IN ACQUISITION TODAY

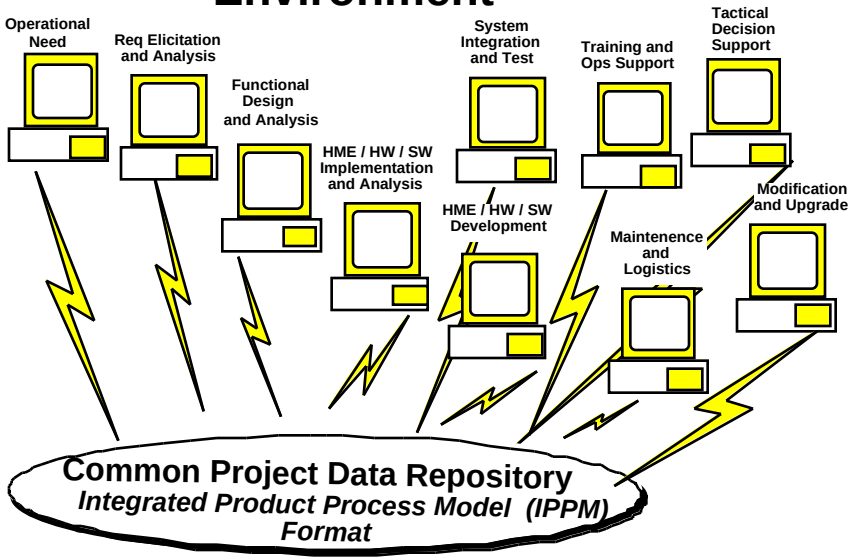


- **Specialized Tools With Limited Scope and Scaleability**
- **No Substantial Interoperability Between Tools**
- **Independent Data Bases With Ad Hoc Configuration Management / Traceability**
- **Initial Process Modeling Tools Not Widely Employed**

LARGELY MANUAL / POINT DESIGN / SIM LAGS DESIGN

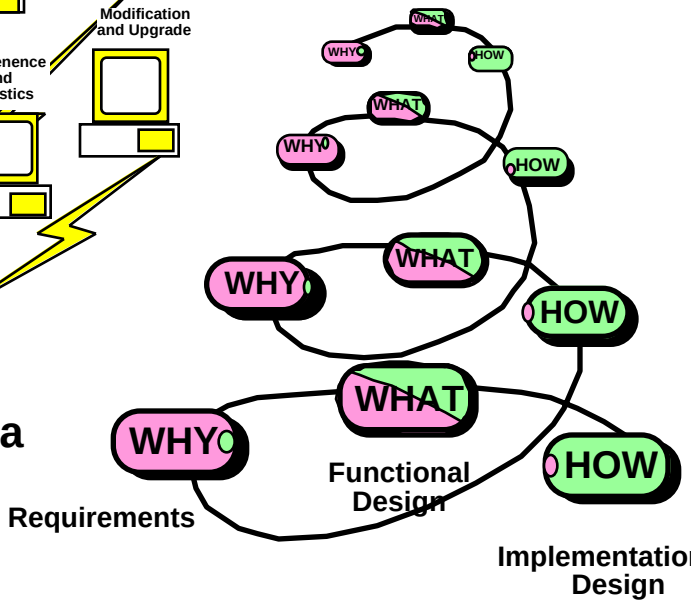
VISION FOR FUTURE M&S EMPLOYMENT

1 Integrated Engineering Environment



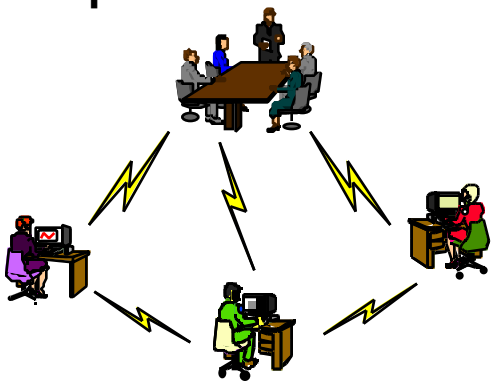
- **Integrated Design Data Schema**
- **Dist Obj Oriented Info Repository**
  - User Transparent Web Style Access
- **Collaborative Distributed Engineering**
  - Seamless Integration of Engineering Disciplines

2 Iterative Acquisition Process



- **Iterative Spiral Process**
  - Rapid Evaluation of Multiple Options
  - Electronic Exchange of System Models

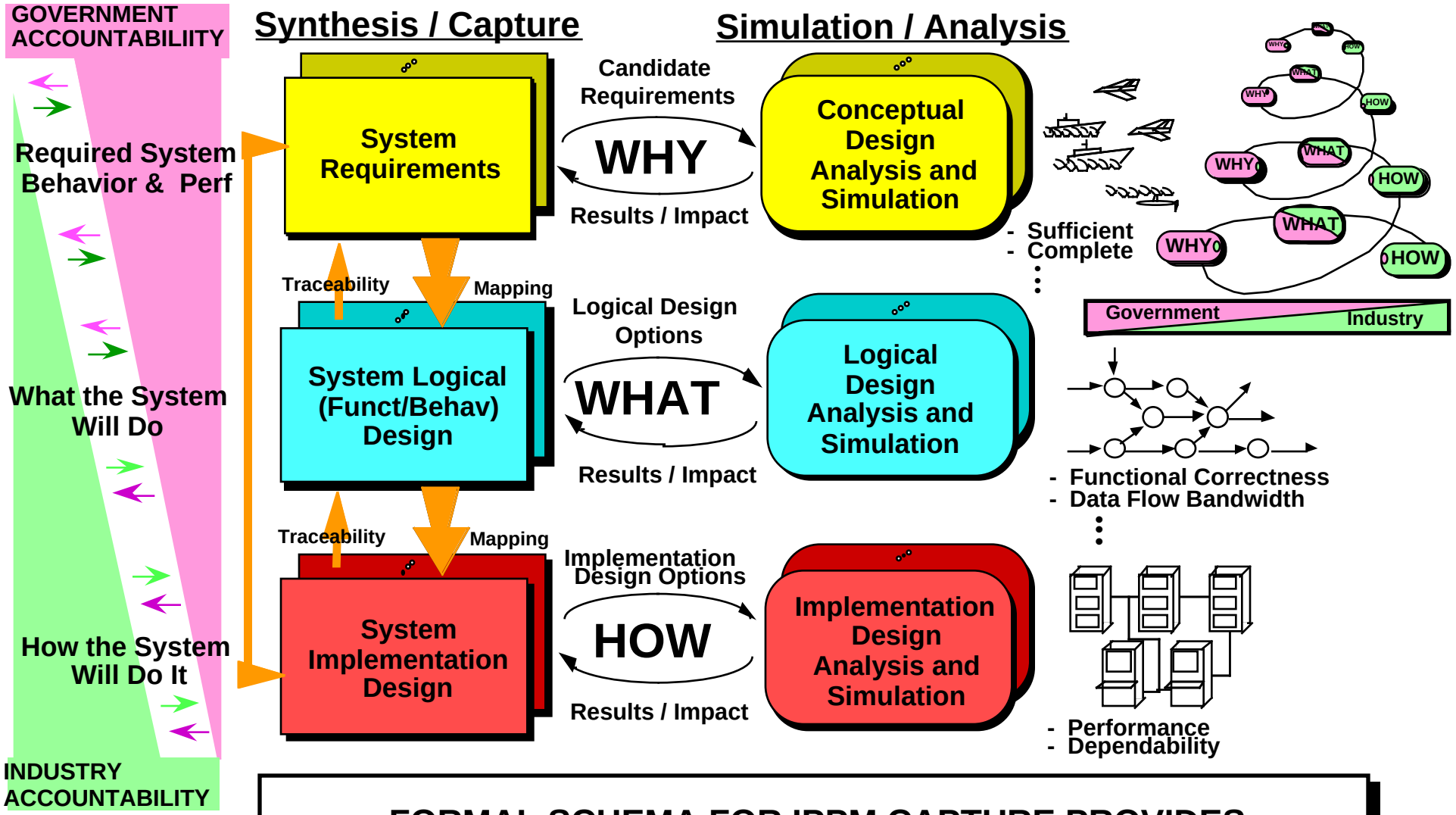
3 Evolved Acquisition Culture



- **Integrated Process Teams**
  - HME and Info Systems
- **Changing Roles and Responsibilities**

EFFICIENT AUTOMATION / MULTIPLE BASELINES
MULTI-DOMAIN / CONCURRENT SIMULATION CAPABILITIES

SBA ENVIRONMENT SUPPORTS ITERATIVE DESIGN PROCESS



FORMAL SCHEMA FOR IPPM CAPTURE PROVIDES DIRECT LINKAGE TO SIMULATION AND MEANS TO ADDRESS GOVERNMENT AND INDUSTRY ACCOUNTABILITY

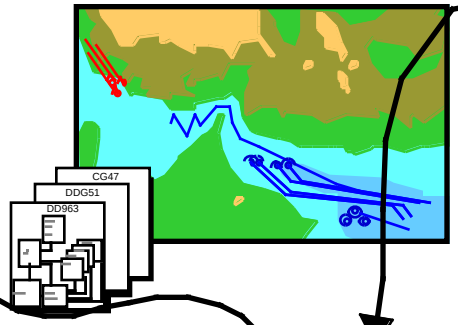
SBA OPERATIONS CONCEPT ILLUSTRATION

2 Conceptual Design Aspect (Gov w/ Ind Participation)

Execute Campaign Level Sim Based on Top Level Req

Establish Required System Capabilities and Quantitative Performance Requirements

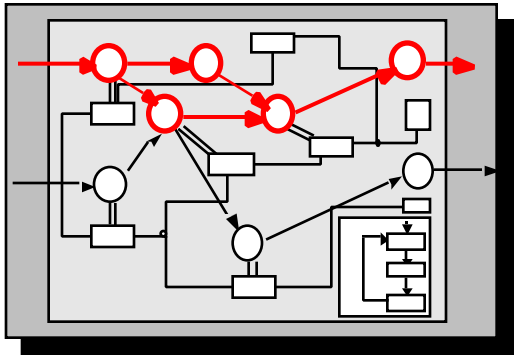
Explore System Concepts and Determine Marginal Utility of Development Options



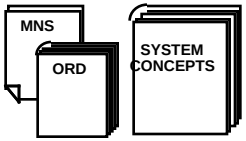
3 Functional Design Aspect (Gov Baseline / Ind Alternatives)

Establish and Validate Functional Baseline
- Funct/Data Flow

Trade-off Functional Repartioning Options



1 Top Level System Req Aspect (Gov Lead)



CINCS and JCS establish a requirement to address emerging undersea threat

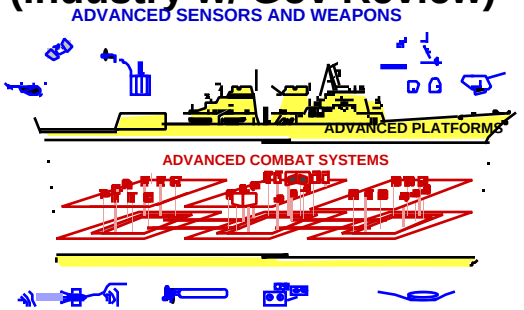
Select reference scenarios and synthetic environments

System Info Repository

Gov

Industry

4 Physical (HME) & Info System (HW/SW) Arch Aspect (Industry w/ Gov Review)

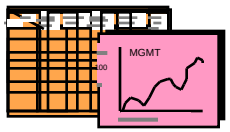


Develop and Simulate System Virtual Prototypes in Multiple Domains

Trade-off Multiple System Implementation Options

Evaluate Dev/Manuf Approach

6 Cost & Schedule Mgmt Aspect (Joint Gov & Industry)

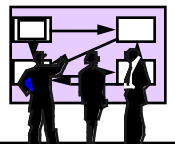


Alert Cost and Schedule Mgmt to Changes in Req, Physical, and Info System Arch

Maintain Cost Baselines for Multiple System Options

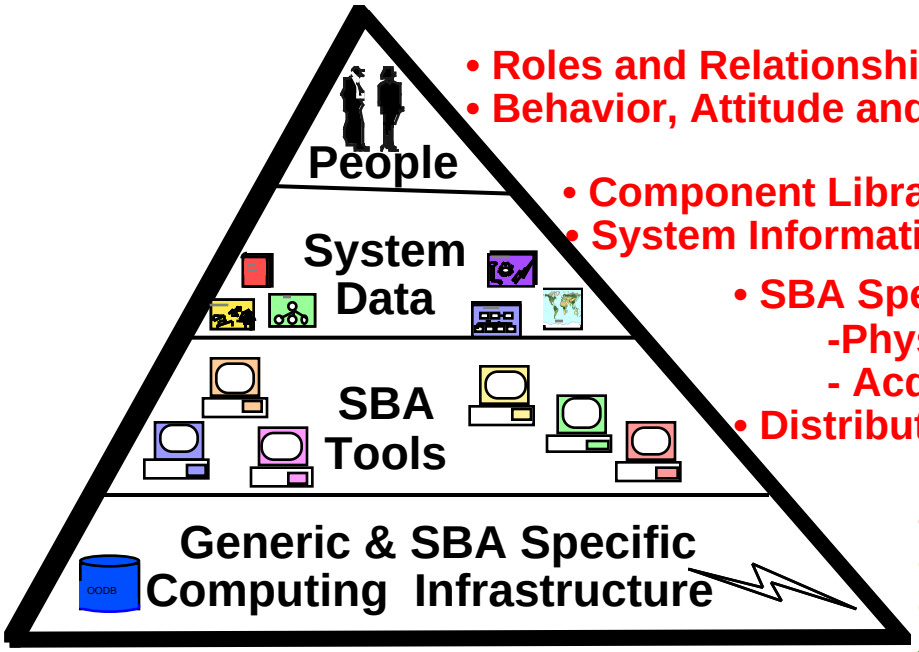
5 Insight / Shared Oversight Aspect (Joint Gov & Industry)

Provide Risk Mgmt and Process Mgmt Visibility Across Program



ACQUISITION AND BUSINESS PROCESS CHANGES ARE CRITICAL TO EFFECTIVELY EMPLOYING AN SBA ENVIRONMENT

SBA ENVIRONMENT LAYERS



- Roles and Relationships
- Behavior, Attitude and Culture

- Component Libraries (COTS, Generic Conceptual)
- System Information Repositiories

- SBA Specific Design Capture and Assessment Tools
  - -Physics Based (HME) & Info Process (Combat System)
  - - Acquisition and Business Process Modeling Tools
- Distributed System Design Repository

- Comprehensive Information Schema
- Adv Dist Sim Run TIme Infrastructure (HLA/RTI)
- Synthetic Environments
- High Performance Computing
- High Speed Networks / Distributed OODB's
- Advanced Communications and Visualization

- ONGOING EFFORTS IN DEVELOPING SBA SPECIFIC INFRASTRUCTURE ARE NECESSARY BUT NOT SUFFICIENT TO SUPPORT FUTURE SBA ENVRIONMENT
  - DMSO HLA / ONR ECS / ARPA STOW

- SBA TOOL DEVELOPMENT CURRENTLY HAMPERED BY LACK OF STANDARDS & COMPREHENSIVE VISION ACROSS THE SPECTRUM OF ACQUISITION DOMAINS

KEY ELEMENTS OF SBA INFRASTRUCTURE

- **Object Request Broker Communications Architecture**
  - **CORBA Based Transparent Communications for SBA Applications**
- **DMSO HLA RTI and Common Technical Framework**
  - **Distributed Simulation Set Up and Execution**
  - **Legacy Simulation Wrapping Toolkit**
- **Object Oriented Data Base System Information Repository**
- **Common Information Representation Schema**
- **Intelligent Agent Based Traceability Support**
- **Common Visualization and Distributed User Collaboration Services**
  - **Synthetic Environment Visualization / 3D Virtual Prototypes**
  - **Messaging, File Sharing, and Desktop Video Teleconferencing**
- **Integrated Engineering Tool Environment**
  - **Engineering Tool Interfacing Toolkit**

TECHNICAL MERIT & BENEFITS OF SBA

ACQUISITION PROCESS EVOLUTION

- ITERATIVE EXCHANGE OF EXECUTABLE SYSTEM REPRESENTATIONS
- DISTRIBUTED COLLABORATIVE GOV/IND SYSTEMS ENGINERING TEAM

ADVANCED SBA ENVIRONMENT

- INTEGRATED DIGITAL DESIGN CAPTURE AND SIMULATION ENVIRONMENT
- AUTOMATED DESIGN CONSISTENCY CHECKING AND TRACEABLITITY
- DIRECT LINKAGE FROM DESIGN CAPTURE TO SIMULATION
- AUTOMATED SYSTEM ENGINEERING PRODUCT GENERATION
  - SSS/SRS/HW Unit Spec/Test Doc

PEOPLE AND CULTURE

- SBD WILL DRAMATICALLY REDUCE THE SIZE OF SYSTEMS ENGINEERING TEAMS
- IPT's AND OTHER NEW ORGANIZATIONAL CONCEPTS WILL PREVAIL OVER TIME
- CHANGING ROLES AND RESPONSIBILITIES WILL NECESSITATE NEW STANDARDS OF BEHAVIOR AND ATTITUDE

TECHNICAL PAYOFF

- QUICK IMPACT ASSESSMENT TO REQ CHANGES (E.G. THREAT CHANGE)
- RAPID EVALUATION OF MULTIPLE DESIGN OPTIONS
- MANAGE TECHNOLOGY INSERTION OPPORTUNITIES
- FACILITATE EFFICIENT COMMUNICATION AND UNDERSTANDING OF DESIGN DATA
- STREAMLINE INTEGRATION AND TEST
- PROVIDE PATH FOR REUSE AND REENGINEERING OF EXISTING DESIGNS
- MAINTAIN STRONGER GOVERNMENT AND INDUSTRY ACCOUNTABILITY

PROGRAMMATIC PAYOFF

- BETTER PRODUCT QUALITY
- REDUCE RISK OF COSTLY DESIGN ERRORS / REDESIGN
- LOWER COST AND SHORTER DEVELOPMENT TIME